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# The Role of Western Participation in Soviet Petroleum Development

An Intelligence Assessment

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# The Role of Western Participation in Soviet Petroleum Development

An Intelligence Assessment

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## The Role of Western Participation in Soviet Petroleum Development

### Key Judgments

*Information available as of 31 August 1989 was used in this report.*

Moscow's goal of maintaining oil production at its present level during the 1990s will require a substantial increase in the supply of technically advanced petroleum equipment, which Soviet industry cannot provide. As a result, the Soviets are pursuing joint ventures with Western firms to manufacture petroleum equipment and to develop Soviet oilfields, which could save both domestic resources and hard currency. Given the current level of world oil prices, however, the costs of developing new Soviet oilfields are generally too high to attract foreign capital, and profit repatriation remains the major obstacle to concluding joint ventures to manufacture equipment. Few joint-venture agreements are likely to be reached in the near term, and these will not be sufficient to produce large gains in petroleum equipment supplies or oil output.

Recognizing these obstacles, Moscow will try to improve the prospects for joint ventures by allowing Western firms greater access to Soviet oilfields and by finding a way for Western companies to repatriate profits without exporting equipment to hard currency countries. One option under consideration is a consortium approach in which a group of firms would pool hard currency earnings. In the oil sector, for example, revenues from oil sales abroad derived from the development of an oilfield could be used to convert ruble profits from sales of petroleum equipment on the domestic market. Another option is the purchase, with ruble profits, of Soviet goods that could be resold on world markets for hard currency. Both options could improve the chances for concluding joint ventures; but they still run headlong into the problem of negotiating an exchange rate as long as the ruble is not convertible. Under these conditions, foreign firms will probably move cautiously before investing heavily in building equipment plants in the USSR.

Without a large contribution from joint ventures, Moscow's options for stabilizing oil output in the 1990s are to allocate enormous investment resources to modernize its petroleum equipment industry and/or to substantially increase imports. We believe Moscow will expand the petroleum equipment sector somewhat, but expansion will not be rapid enough to completely satisfy demand. Furthermore, investment needs of other sectors, particularly those supporting Gorbachev's ambitious consumer welfare goals, will limit the use of this option.

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The Soviets probably will need to increase imports of Western oil equipment. If Moscow remains committed to keeping oil output above 12 million barrels per day and does little to improve joint ventures, we believe these imports could grow from their current level of roughly \$2 billion to \$6 billion by the mid-1990s. Under these circumstances, the United States would have promising opportunities to sell oilfield equipment, although US producers would face tough competition from West European petroleum equipment manufacturers. Despite Moscow's need for imports, however, Soviet hard currency supplies are expected to remain tight as other industrial sectors—particularly the consumer-related industries—compete for these scarce resources.

Failure to expand Western participation in joint ventures, in short, would leave the Soviet oil industry in a "catch-22" situation in the 1990s. Diverting resources to this sector would conflict with regime programs to stimulate economic growth and improve consumer welfare. Yet, without these resources, oil output could drop sharply, leading to a substantial reduction in the availability of oil for export. This would severely reduce hard currency earnings and reduce Moscow's ability to purchase much-needed machinery, foodstuffs, and consumer goods.

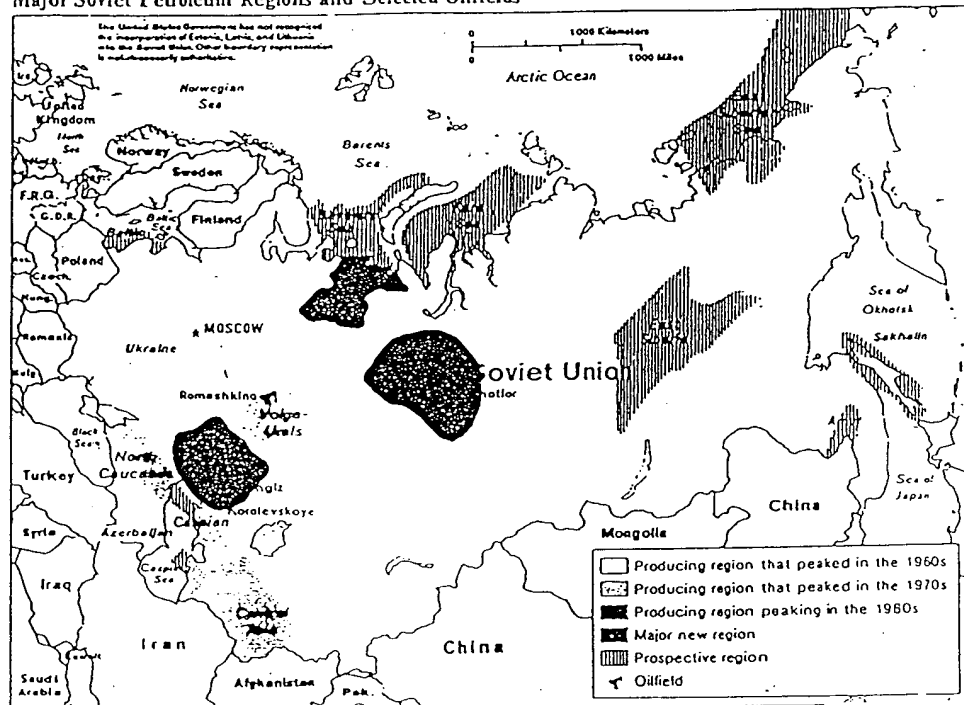
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Figure 1  
Major Soviet Petroleum Regions and Selected Oilfields



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## The Role of Western Participation in Soviet Petroleum Development

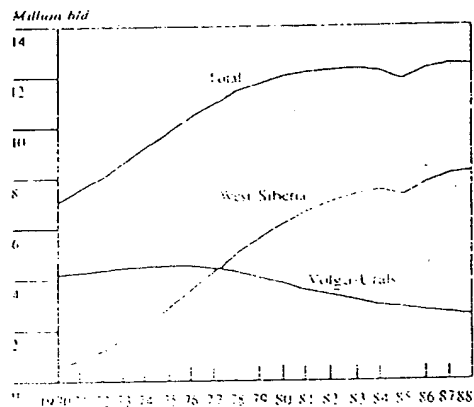
**The Challenge of Maintaining Oil Production**  
To fuel domestic economic growth, finance hard currency imports from the West, and meet the energy needs of allies and clients, the Soviet Union has pushed its production of oil to the world's highest level. In the 1990s the pressures that have driven oil production will probably remain strong:

- Oil use in industry and other sectors of the economy is not likely to fall much—if at all—during the 1990s. Moscow's program to substitute natural gas is reducing fuel oil use, but this saving is being offset by rising demand for motor and aviation fuels. The leadership has not yet undertaken the extensive economic reform that would provide effective incentives for substantial energy conservation.
- With military and nonenergy exports likely to be weak and Soviet reluctance to increase foreign borrowing strong, Moscow will have to maintain high levels of oil exports to the West to pay for purchases of grain, machinery, and consumer goods.
- Moscow also will need to continue oil exports to Eastern Europe to maintain close economic and political ties to CEMA partners. Soviet oil exports currently account for about 80 percent of Eastern Europe's oil consumption.

In response to these pressures, the Soviets currently plan to keep oil production at about its current level (12.2 million barrels per day (b/d))—throughout the coming decade.

Stabilizing oil production at its present level, however, poses formidable challenges. In nearly all existing oil regions, oil production is falling, and the Soviets must cope with deteriorating production conditions (see figure 1). In West Siberia, which now accounts for two-thirds of national output, production appears to be peaking as large, easily exploited fields are becoming depleted (see figure 2). In these older oil reservoirs, the pressure needed to move oil to the surface has

**Figure 2**  
**USSR: Oil Production, 1970-88**



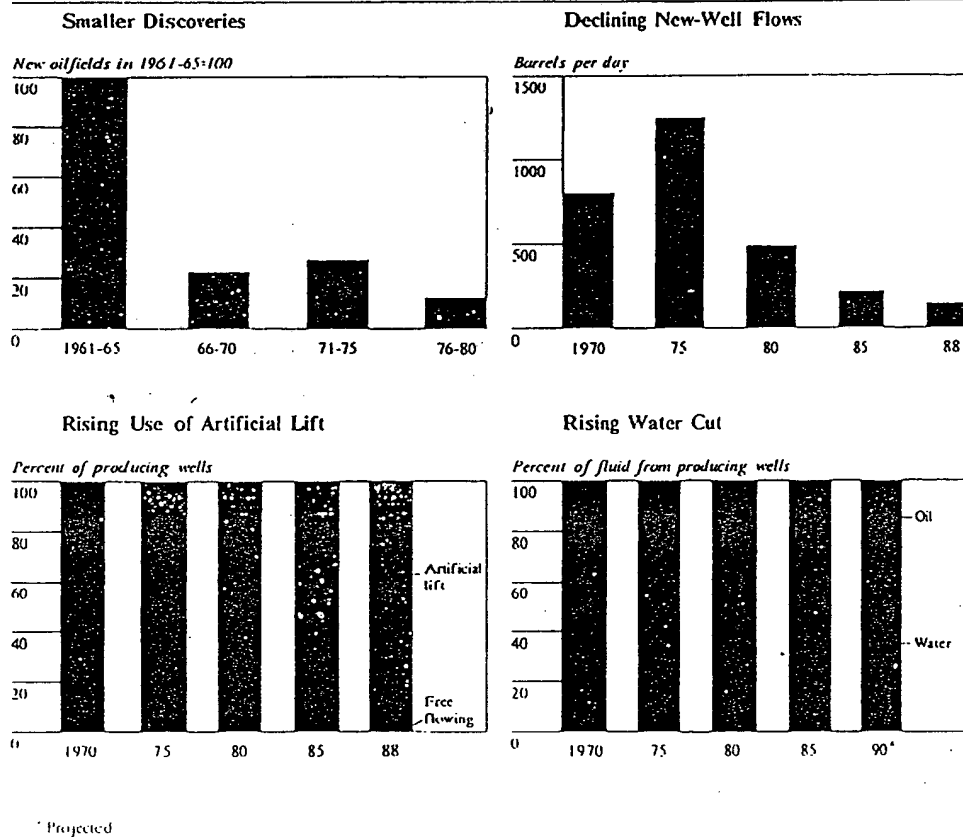
fallen, increasing the industry's need for artificial lift of fluids (see figure 3). The share of water in fluids produced from older fields is high and growing, because of both aging and waterflooding. To cope with these conditions, the Soviets need sophisticated enhanced oil recovery methods, better pumping and automated control equipment, and more effective methods of increasing well flows from old wells. Moreover, much of the equipment and infrastructure in West Siberia will be 15 to 20 years old by the mid 1990s and will need to be replaced.

As production is concentrated in older oil reservoirs, which contain less oil than newer ones, the need for additional oil out of the reservoirs and from the high costs of producing with older



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Figure 3  
The Rise and Fall of a West  
Siberian Oil Basin: Tyumen'



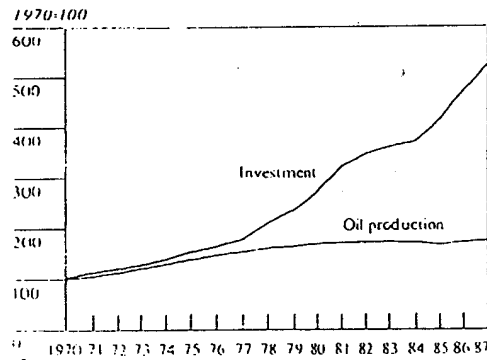
With the decline of the large, older fields, the Soviets have had to rely increasingly on smaller, less productive, and geologically more complex West Siberian fields to sustain oil production. As a result, new well flows have fallen sharply while investment costs and drilling requirements have increased dramatically.

Soviet investment in the oil industry has doubled since 1980, but production has increased barely 3 percent (see figure 4). Both our analysis and Soviet sources indicate that the demand for oilfield equipment will

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Figure 4  
USSR: Rising Cost of  
Oil Production, 1970-87



continue to rise rapidly in the 1990s. A Soviet petroleum economist, for example, has estimated that drilling requirements in the mid-1990s will be 60 percent higher than current levels, and almost double in the late 1990s.

Exploitation of the new oil regions, which are located in more distant and less hospitable areas, poses major technical challenges that the Soviets have not faced before on a large scale:

- In the North Caspian basin, new fields are large, but the oil is very difficult to extract, process, and transport. The producing formations are very deep, are under extremely high pressure, and contain substantial volumes of toxic and corrosive hydrogen sulfide gas.
- In the Barents Sea, oil production would entail offshore drilling in arctic waters on a scale never before attempted by the Soviets.

- In East Siberia, the oilfields are much smaller and more complex than fields in West Siberia. The complexity of the reservoirs, the severe climate and terrain, and the distance to industrialized centers have limited exploration to date.

#### Moscow's Old Development Strategy and Gorbachev's Modernization Efforts

The Soviets have relied mainly on domestic industry to provide the equipment needed for oil development. Soviet oilfield equipment, however, is generally of low reliability and poor quality. The Soviet press often reports that much equipment delivered to the work site is defective and needs to be repaired before it is used. Reliability aside, the level of Soviet oilfield-equipment technology is, on the whole, 15 to 20 years behind world standards because:

- Nearly all Soviet petroleum equipment plants are old and outfitted with obsolete manufacturing technology (see inset).<sup>2</sup> As the quantitative demands of the oil sector rose rapidly in the late 1970s, Soviet petroleum equipment plants raced to increase supply, and few funds were spent on modernizing the plants.<sup>3</sup> Consequently, there is little advanced milling and numerically controlled equipment. Quality control is poor, and plant automation and integration are generally on a low level.
- New-technology R&D was rarely emphasized. Indeed, the press reports that many lab facilities were converted to production floorspace to keep pace with the demand for more and more equipment. Moreover, the isolation of R&D institutes, manufacturers, and oilfield-equipment consumers from each other essentially froze technology in place.

<sup>2</sup> Sixty percent of the USSR's oilfield equipment is produced in plants located in or near Bakou, one of the country's oldest producing regions.

<sup>3</sup> A 1985 press report indicated that output of petroleum equipment had tripled in the preceding 10 years but without a substantial introduction of new manufacturing capacity or machinery. The report indicated further that 30 percent of manufacturing capacity was still dependent on manual labor.

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### Evaluation of a Soviet Petroleum Equipment Plant

Although the plant was reportedly built about 20 years ago, it is one of the USSR's most modern. The plant—on a scale of one to 10—rates a four when compared with Western facilities. The plant is reportedly geared toward long production runs of relatively few parts and has little flexibility.

The plant displayed the following major deficiencies:

- Numerically controlled machines were few in number and used only for working large pieces; consequently, tolerances (variations permitted in maintaining a specified dimension) exceeded Western standards.
- Machined parts were not protected when moved, and many appeared nicked and scratched, resulting in imperfect equipment assembly.
- No abrasive blasting equipment was present for removing scale from metal before plating, a process necessary for adequate corrosion protection.
- The heat-treatment department lacked a vacuum furnace for minimizing impurities in steel and improving strength.
- There was no hardness tester or X-ray inspection of welds, increasing the likelihood of equipment failure.
- Quality-control equipment and precision-measuring instruments were in short supply.
- The plant's lab contained mainly analog equipment and few of the more accurate direct-measuring devices.

The underlying cause of this state of affairs was an economic system that discouraged risk and innovation, imposed little or no penalty for low-quality goods, and rewarded enterprises primarily for fulfillment of production quotas.

To compensate for the deficiencies of the domestic equipment industry, Moscow has selectively turned to the West for technology and high-quality equipment to obtain improved operating performance and more reliable service (see inset). Imported equipment has enabled the USSR to cover critical shortages in its own supplies and to cope with particularly difficult technical problems. For example, the turnkey assembly yard near Baku—provided by France—remains the USSR's only source of deepwater drilling platforms (see figure 5). Without this yard, offshore oil production in the Caspian Sea—which has allowed the Azerbaijan Republic to stabilize production—would have been severely curtailed.\* Also, Western imports of high-strength, corrosion-resistant drill pipe and special oil-treatment plants have been and will remain critical to developing deep oil deposits with high concentrations of hydrogen sulfide that are typical for the North Caspian basin. Most Soviet oilfield equipment is unsuitable for such extreme operating conditions.

Turnkey plants quickly provide equipment that often would take much longer to develop domestically, but Moscow does not see turnkey plants as a long-term solution to the oil equipment problem. They are expensive, requiring major outlays of scarce hard currency. Moreover, after the Western firm completes the contract, Soviet-style quality control often reduces the advantage of Western manufacturing processes.

\* Similarly, according to [ ] drill bits produced at the Kuybyshev plant—equipment for which was provided by a US firm—continue to be of "significantly higher quality" than ones produced with Soviet designs and production processes.

### *Imported Petroleum Equipment: Helping To Fill the Gaps*

*During the 1970s and early 1980s, the USSR bought about \$2 billion of Western oil equipment. Especially important among these acquisitions were:*

- *A turnkey plant to produce high-quality drill bits from [C] 3*
- *Gas-lift equipment from [C] 3 although key components came from [C] 2 for two major oilfields in West Siberia.*
- *An assembly yard for producing offshore drilling platforms from [C] 3*
- *Approximately 1,200 high-capacity electric submersible pumps from [C] 3*
- *Equipment and chemical plants for enhanced oil recovery projects.*

*In recent years, the Soviets have purchased a seam-less-pipe mill from [C] 3 for the Volzhskiy pipe complex and oil-treatment plants for the Tengiz oilfield. The Volzhskiy pipe mill will probably start production this year. One treatment plant at Tengiz is nearing completion, and two others are in the early stages of construction.*

*The Soviets are currently discussing turnkey projects to build an offshore loading terminal for Kolguyev Island in the Barents Sea, upgrade the Kuybyshev bit plant, reequip the Drogobych well-completion plant, and modernize a plant in Baku that produces gas-lift components. In addition, the Soviets are also discussing a licensing agreement with [C] 2 10 to manufacture power tongs for handling drill pipe.*

and equipment. After construction of the plant, the Soviets rarely are able to advance or upgrade the technology.

Gorbachev's efforts to improve supplies of oilfield equipment under the old development strategy have had little success. He noted in September 1985 that

the "end of the era of golden gushers" would impose new qualitative demands on equipment. At the same time, he called on machine builders to undertake a new program to produce high-quality, technically advanced oilfield equipment

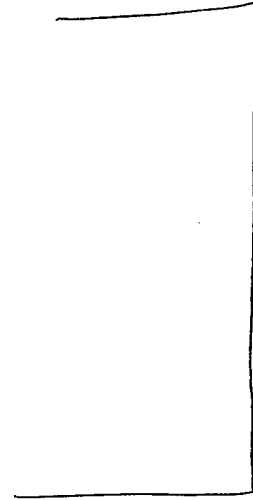
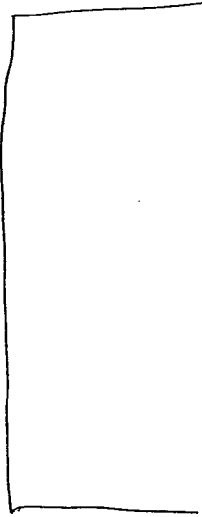
The program to modernize the petroleum equipment sector, however, is evidently failing. In late 1988 a deputy oil minister reported that the program for qualitative and technical improvement of petroleum equipment had been "quietly smothered" and that the Council of Ministers Bureau for Machine Building, after repeated adjustments, had "emasculated" the program. The machine builders have reportedly produced just one product from a list of 64 technologies deemed critical for the oil sector

Gorbachev may have underestimated the scope of the problem in the petroleum equipment sector and the amount of time and money needed to create an industry capable of manufacturing world-class petroleum equipment. Moreover, by reducing the role of Moscow-based planners in providing equipment to oil producers, his economic reforms appear to have disrupted rather than facilitated the flow of domestically produced equipment to the oil sector. Only about 30 percent of the equipment for the oil sector is guaranteed by state orders this year. The remainder has to be negotiated separately, and the machine builders are driving a hard bargain. Prices for oilfield equipment have risen sharply in recent years, according to Soviet press reports. Moreover, oilfield-equipment manufacturers have discontinued output of some needed equipment because, under self-financing, it is not profitable for the plants to produce it.

### *A New Turn to the West: Smarter and Cheaper*

Recognizing these domestic deficiencies, the Soviets have defined a new role for Western firms by seeking their direct participation in nearly all aspects of the oil industry. Gorbachev's policy of *glasnost* is facilitating this participation by allowing the Soviet oil industry for the first time to provide the detailed

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oilfield data required by Western companies to make business decisions. For example, the Soviets have recently provided Western businesses with a detailed development plan for the very large Tengiz oilfield complete with well locations, pipeline corridors, well flows, and production plans. *Glasnost* is allowing concerns about the environment to play a larger role in economic policy. This has resulted in increasing interest in Western equipment, which is superior to domestically produced equipment in the area of environmental safeguards.

The Soviets are actively pursuing joint ventures for oilfield development and for manufacturing a wide variety of oilfield equipment. In these projects, Western companies and Soviet organizations both make equity contributions and form independent businesses operating in the USSR. Soviet joint-venture proposals

call for the Western partners to provide technology, equipment, and hard currency funds. The Soviets would provide buildings, raw materials, land, access to deposits, and equipment. The output from the joint venture—oil in a field development deal or petroleum equipment in a manufacturing joint venture—would be sold both domestically and on the world market. Exports to the West are needed to earn hard currency that the Soviet and Western partners share on the basis of equity contributions.

Moscow also is seeking to form joint-venture service companies to perform specific but limited field development tasks. Unlike projects to jointly develop oilfields, the Soviets would retain complete control of oil operations, and the Western firms with service agreements would have no rights regarding oil reserves.

Although these agreements are likely to be referred to as joint ventures, the service company would be essentially a contractor entitled to a share of the increased output resulting from a particular service.

In theory, joint-venture arrangements offer the Soviets numerous advantages. For example, successful joint development of oilfields would allow the Soviets to accelerate development with smaller outlays of both domestic resources and hard currency. Furthermore, each joint venture would give the Soviet oil industry unprecedented access to some aspects of Western technology that the Soviets could apply more widely in petroleum production. In some cases, technology transferred to joint ventures by Western firms—particularly exploration equipment—could have military applications (see appendix B).

Involvement in joint ventures would also enable the Soviets to benefit substantially from Western expertise and decisionmaking (see inset). This expertise will be important as oil production conditions deteriorate in the future:

- In addition to having advanced equipment, Western firms have superior expertise in interpreting seismic recordings.<sup>1</sup>
- Western management could provide substantial assistance in modeling geologically complex oilfields, planning their development, and selecting the proper equipment to optimize production.
- To carry out well-stimulation techniques and enhanced recovery in older fields, substantial empirical knowledge and experience are essential. For example, because of very high pressures in hydrofracturing, care must be taken to implement this technique properly or the oilfield could be damaged.

<sup>1</sup> Seismic data are repeatedly processed to eliminate noise and amplify desired signals. Properly interpreting the data requires an ability to distinguish noise from desired signals—which depends on the geologic setting and required level of accuracy—and the software designed to take this into account.

<sup>2</sup> Hydrofracturing is a technique to stimulate production from old wells by pumping a fracturing fluid under high pressure into the formation. The fluid contains propping agents such as coarse sand or glass beads to keep the fissures open after the pressure is released.

#### How Can a Major International Oil Company Help?

Soviet and Western operating practices differ dramatically. To illustrate, one [ ] cited a field in the Komi area that was proposed as a potential joint-venture project after the Soviets botched an attempt to develop the field. The Soviets drilled a few exploration wells, estimated recoverable reserves at 1 billion barrels, and almost immediately began construction of roads and a pipeline. A large number of rigs began drilling while construction of field infrastructure was accelerated. Unfortunately for the Soviets, the field turned out to be very complex. The oil—with a high wax content—congealed at a relatively high temperature, and an expensive enhanced oil recovery program will be needed to extract the oil. [ ] the Soviets eventually reduced their estimate of recoverable reserves to 50 million barrels and also concluded that the pipeline will have to be scrapped.

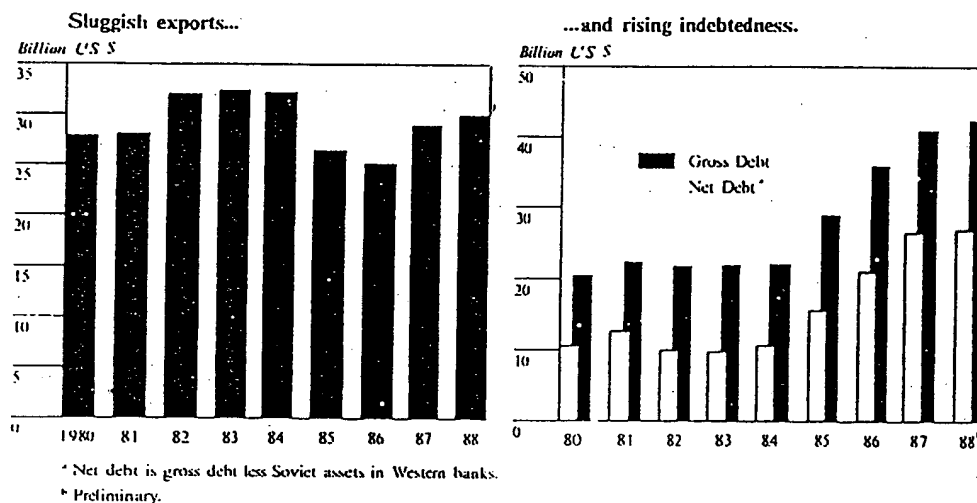
Western operating practices would have prevented this type of miscalculation: [ ]

[ ] a Western company would have taken a much more cautious approach, drilling only a few initial wells, beginning production on a small scale to understand and gauge the problem, and then undertaking a test program to learn what works before devoting enormous financial and labor resources to the field.

Mishandling a difficult oilfield is not a unique experience for the Soviets and is likely to occur more frequently as the quality of oilfields continues to deteriorate. In such cases, Western management expertise would almost certainly improve efficiency and reduce operating costs. Coordination of different aspects of development would improve, and in the long run production and total recovery would also increase.

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Figure 6  
USSR: Hard Currency Constraints,  
1980-88



In addition to the technical and managerial advantages, joint ventures with Western firms offer several financial benefits. Moscow sees the new role for Western firms as a way to acquire Western technology and expertise at a far lower hard currency cost than outright purchases would require. The prospect of achieving such hard currency savings is especially attractive because:

- Soviet hard currency earnings remain substantially below levels recorded in the early 1980s in real terms. Reduced energy revenues and a depreciated dollar have seriously eroded the USSR's import capacity. In addition, Moscow has largely failed to increase sales of nonenergy and nonarms goods and will continue to rely on energy exports as the foundation of hard currency earnings well into the 1990s.

- The Soviets have continued to sell large volumes of gold in recent years but are unlikely to push these sales much higher. A large jump in gold exports would probably put severe downward pressure on prices, raise the ire of other international traders, and work strongly to the USSR's disadvantage over the long term.

- Moscow is concerned with rising indebtedness to the West and is trying to hold the line on hard currency borrowing (see figure 6). Gross debt has risen substantially since Gorbachev came to power, but much of this increase is the result of the depreciation of the dollar against the Western currencies in which a large portion of Soviet debt is denominated. Despite

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calls from some Soviet officials to boost borrowing substantially, Moscow is likely to continue taking a cautious approach, keeping the increase in borrowing to manageable levels.

#### **Beyond the Rhetoric: Making a Deal**

Despite the strong Soviet interest in joint ventures, Western participation in Soviet oilfield development and manufacture of petroleum equipment will require resolution of many contentious issues. Profit, repatriation is clearly the most difficult issue to resolve. In most instances, the Soviets continue to insist that hard currency profits must be derived from sales of the venture's products in the very limited domestic hard currency market or via exports to the West. Profit repatriation will be a substantial problem for foreign petroleum equipment companies that want to take advantage of the domestic Soviet market, but of less concern to firms engaged in joint development of oilfields that can earn hard currency by exporting oil to the West.

Financing joint ventures also is proving to be a problem because Western firms are reluctant to invest substantial company funds in projects with uncertain returns. Thus, most joint ventures will find their combined equity contributions are too small to initiate or sustain operations and will have to seek hard currency financing. For the offshore Sakhalin project, for example, [redacted] were unwilling to finance the deal until the Soviet Bank for Foreign Economic Relations agreed to step in and guarantee the loans.

In addition, a host of operational issues are proving troublesome but may be easier to resolve than the financial concerns (see inset). The Soviets are trying to address some of these problems through their legislative process. For example, last December the USSR Council of Ministers passed a resolution that allows foreign partners to gain greater control over a joint-venture's operation. The resolution now permits the foreign partner to have a majority share of the joint venture, the chairman of the board or the director general to be a Westerner, and the enterprise management to make personnel decisions.

The Soviets are also trying to solve some problems on a piecemeal basis by showing flexibility in negotiations for individual contracts. For instance, Moscow is well aware of the importance of quality control, recognizes that Soviet workers know little about it, and appears eager to learn Western quality control procedures. In one case, [redacted] was given sole responsibility for quality control in assembling instrumentation for refineries and allowed to completely shut down manufacturing lines. The Soviets also appear willing to defer to the judgment of the Western partner for major decisions such as the acquisition of equipment for critical applications. For example, the Soviets have entrusted a Western firm with the sole responsibility for equipment selection for a proposed cold-weather offshore production deal. However, some problems, such as lack of infrastructure and difficulty in securing a reliable source of quality supplies, may be far more difficult to solve.

Reaching agreement on all of these issues has proved to be a lengthy and frustrating process. Joint-venture contracts are complex legal and technical agreements that require many terms and conditions to be spelled out in detail, and the Soviets have almost no experience in drafting these documents. In a recent case, the Soviet negotiating team—after making little progress on its own—left formulation of the entire agreement to the Western partner, but such situations are likely to remain few and far between. Because of the problems in concluding these agreements, few petroleum joint-venture deals have been concluded to date. Moscow, however, continues to intensely pursue these projects, particularly joint ventures to perform exploration and field-services work, joint development of oilfields and joint production of petroleum equipment.

*Joint Exploration and Field Services.* The Soviets are discussing several deals to allow Western firms to run seismic surveys. Proposals have been made to Western firms to explore in the North Caucasus and in East Siberia—where there are large amounts of folding



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#### Key Issues in Joint-Venture Negotiations

**Operational Control.** Western partners are still concerned about their ability to control the day-to-day operations of the joint venture, despite recent favorable changes in the legislation. Decisions on important operational activities are now reached by unanimous agreement of the board members, limiting control by the Western partner. Western firms believe that control is necessary to ensure the quality of production and to determine development goals for the projects. For example, in oilfield joint ventures, Western firms may prefer slow development to maximize production over the long term and spread out capital outlays while minimizing financial risk; the Soviets, however, may want accelerated development to show near-term results. For joint ventures that manufacture petroleum equipment, quality control is essential so that the equipment could potentially be sold for hard currency.

**Personnel.** Joint-venture regulations state that joint enterprises will be manned mainly by Soviet citizens, but Western firms are worried about low worker productivity caused by alcoholism, a poor work ethic, and Soviet laws protecting workers. Western partners also want to have a voice in selecting and training Soviet workers. If unqualified workers are selected, they would need a long training period to learn to handle equipment and production procedures. Even if given greater control over hiring, however, Western firms, which possess little knowledge of the work force and face language barriers, will have to depend heavily on Soviet input for worker selection.

**Lack of Infrastructure.** This obstacle runs the gamut from difficulties in obtaining factory premises, office space, living accommodations, and telephone services in urban areas to the lack of roads and pipelines in

more remote regions. For example, a US firm, which is involved in a joint venture to assemble process-control instrumentation for oil refineries, has been unable to find suitable offices in Moscow and has been operating out of three hotel rooms, according to the Western press. Getting even basic services is particularly difficult in some of the more distant and inhospitable regions, where many of the new fields are located.

**Material Supply.** Joint enterprises are dependent in many cases on the Soviet distribution system to obtain the appropriate quantity and quality of needed raw materials, labor, and other inputs. Some non-petroleum-related joint ventures have already reported problems in this area. One Western participant reports, for example, that his joint venture has had to place orders with Soviet enterprises well in advance if it hoped to get its supplies, and even then could not be certain of their delivery date, quality, or price.

**Equipment Procurement.** In some cases, the Soviets may insist that, as part of their equity contribution, some Soviet equipment must be used that Western firms will find unsuitable.

**Valuation of Capital Contributions.** This issue is likely to pose problems because it is often difficult to put a price tag on inputs such as Western technology and know-how, as well as Soviet real estate, production facilities, and services. The valuation of equity that each partner brings to the joint venture is important because it determines profit distribution.

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and faulting; in the North Caspian basin—where deposits are deep and returning seismic signals are distorted by a thick layer of salt; and in the Barents Sea—where ice and severe wind and wave conditions prevail. In addition, the Soviets have proposed selected enhanced recovery projects in the Volga-Urals area and well-stimulation projects for West Siberia and the North Caucasus. The Soviets are also discussing a joint venture to acquire Western management expertise for oil well preventive maintenance, a project designed to reduce the number of idle wells and thereby boost oil production.

We believe that these types of field-services deals have an excellent chance to be finalized. Such arrangements appear beneficial to both the Western and Soviet partner. A share of increased oil production from a newly discovered field, from an aging field, or from a low-producing well can be used to earn hard currency to pay the Western firm. The Western company's equity contribution is relatively small, and the Soviet Petroleum and Gas Industry Ministry acquires advanced exploration techniques that could be applied in East Siberia, as well as stimulation technology that could be used in the Volga-Urals and in West Siberian producing regions.

*Joint Development.* The Soviets are also looking for help in developing certain oilfields in the Komi region, oilfields off Sakhalin Island, and the Korolevskoye oilfield in the North Caspian basin. They have sought US partners for these projects because US firms for several years have successfully produced oil from the sort of low-quality reservoirs and difficult fields that the Soviets will increasingly encounter in the 1990s. In some cases, US technology is more efficient than other Western technology and can offer a major savings in capital outlays. For example, the US firm that will develop fields off Sakhalin Island plans to use an ice-resistant steel platform, while a Norwegian company had proposed the use of a very expensive, oversized concrete structure. As a result, the US firm's proposal was far more economical at current world oil prices.

Providing equipment and services to operate in these difficult conditions and harsh environments will also present opportunities to Western companies to improve their own oilfield technologies. For example, exploration and development of Soviet areas such as the Barents Sea and off Sakhalin Island could advance the technology for operating in cold, ice-prone offshore areas. US firms believe that such experience would increase their competitive advantage over other Western companies in providing certain types of equipment.

Each of the proposed joint-development projects under discussion would give the Soviets substantial opportunities to learn new techniques that eventually could be applied to a much larger number of fields. But Western firms are not likely to undertake joint development unless oil can be produced profitably at current world oil prices:

- The Komi project, for example, would allow the Soviets to improve their ability to operate in permafrost and to remove oil that congeals at a relatively high temperature. They could apply these techniques in northern West Siberia and in East Siberia in the future. We believe, however, that the Komi deal has only a small chance of being finalized because costs of production probably would exceed world oil prices.
- Technology gained from joint development of the oilfields off Sakhalin Island could be used in future development of oilfields in the Barents Sea. In contrast to the Komi project, the Sakhalin venture has an excellent chance of being finalized because the US company involved believes oil can be produced profitably.
- Joint development of the Korolevskoye field would help the Soviets to cope better with deep wells, high pressure, and large volumes of toxic gas—conditions

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which characterize the North Caspian basin. The Soviet Government probably will finalize this venture despite objections from some officials of the Ministry of Petroleum and Gas Industry, who believe that Korolevskoye is technologically accessible and can be developed without direct Western participation.

Despite the likelihood that the Sakhalin and Korolevskoye deals will be concluded, prospects for a large number of joint-development projects in the near future are poor. Under present Soviet joint-venture policy, such ventures are easily negotiated only if they involve profitable oilfields that are beyond the technological reach of the Ministry of Petroleum and Gas Industry. Ministry officials are still under pressure to meet delivery quotas and have no desire to pour labor and capital resources into a joint venture only to relinquish a large share of production to a Western partner. Without full cooperation from the Ministry, joint-development projects would proceed slowly at best and more likely would fail.

*Joint Production of Petroleum Equipment.* In addition to contracting for Western geophysical services, the Soviets are seeking joint ventures to manufacture sophisticated, interactive surveying systems and well-logging equipment for geologic evaluation of rock formations during drilling. The Soviets are also pursuing a joint venture for automated control equipment, technology that is particularly useful in remote, arctic environments like West Siberia, to efficiently monitor and control a large well stock.

Many joint-venture proposals have been made by the Soviets to improve drilling efficiency. Because of the continued decline in new well flows, the Soviets must drill and complete wells at an ever faster pace. Aware of this requirement, they are discussing a wide range of joint ventures to produce drilling equipment (see figure 7).

We believe, however, that joint ventures to manufacture petroleum equipment face almost insurmountable problems regarding profit repatriation. Because of depressed oil prices, the potential of selling equipment on world markets to earn hard currency to pay the Western partner is likely to remain limited. Such joint ventures would compete in an already flooded market

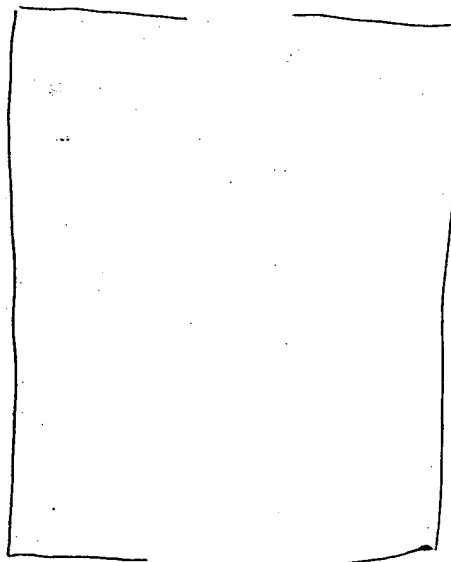


Figure 7. State-of-the-art Western drill rig capable of operating in temperatures down to  $-45$  degrees Celsius.

against products manufactured elsewhere by the Western firm. Moreover, even though products of joint ventures would be produced with Western technology and supervision, they probably would not be up to Western quality standards, at least in the near term, because of substandard inputs and the poor discipline of Soviet workers.

#### Will Moscow Change Joint-Venture Policy?

Despite the problems that joint ventures are encountering, we believe that there is little chance that Moscow will revert to its former policy of prohibiting direct Western participation in Soviet oilfield development, barring the replacement of the Gorbachev leadership by a more autarkic regime or the discovery of a supergiant oilfield that could be developed primarily with domestic equipment. The current leadership appears to be strongly in favor of Western

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involvement in Soviet industrial development, particularly in those areas such as the oil sector, where domestic technology is inadequate.

There is a much better chance that Moscow will allow greater access to Soviet oilfields, particularly if oil production falters. Success in field-development joint ventures will encourage Moscow in this direction. **E**

**1** Both deals would provide the Soviets with increased output and the Western firm with hard currency profits.

Moscow is also likely to seek to improve prospects for joint ventures to produce petroleum equipment. For such ventures to appeal to Western firms, Moscow must find a way for Western companies to repatriate profits without exporting equipment to hard currency countries. One option under consideration is using a consortium approach in which a group of firms would pool hard currency earnings. In the oil sector, for example, hard currency revenues from oil sales derived from joint field development could be used to convert ruble profits from sales of petroleum equipment on the domestic market. Although the Ministry of Petroleum and Gas Industry would be conceding output from an oilfield, such a scheme would offer high-quality petroleum equipment in an exchange that would be used to boost industrywide production.

The Soviets are also examining other measures that would allow Western firms to repatriate profits that could be applied to joint enterprises that produce petroleum equipment. These include:

- Exchanging rubles for hard currency with other Soviet enterprises. The Soviet press reports that these operations would be carried out through Soviet banks, with hard currency sold "at the official

\*The Soviets have already reached an agreement with a group of six US companies known as the American Trade Consortium. Under this agreement, the hard currency profits earned by an oilfield-development joint venture with a US energy company will be used to convert the ruble profits from sales of consumer goods produced by joint ventures with other consortium members.

rate or at another rate that is agreed upon by the contracting agents." Joint enterprises also may be allowed to participate in hard currency auctions that were legalized by a December 1988 resolution on foreign economic activity.

- Acquiring Soviet goods with ruble earnings for export to the West. This option reportedly would be available only to joint enterprises that embody advanced technology and produce "new" products for the Soviet market. A further limitation is that Moscow would select a list of goods that may be exported in this manner.
- Permitting a limited amount of ruble convertibility. In an interview with a US newspaper, a Soviet trade official indicated that Moscow may allow some enterprises to convert some rubles into hard currency through state financial institutions. This option would only be open to enterprises that produce priority goods as determined by Moscow. Gorbachev's adviser Abel Aganbegyan has also suggested that limited convertibility would be allowed in free economic zones.

In our view, however, unless the Soviets make the ruble completely convertible—which is unlikely in the near term—they will be hard pressed to find an adequate, secure mechanism for paying the Western partner. Under these conditions, foreign firms will probably move cautiously and slowly before investing heavily in building equipment plants in the USSR.

#### Outlook

Our analysis indicates that, under current Soviet joint-venture policy, comparatively few joint-venture agreements are likely to be signed in the near term. These will not produce large gains for the Soviets in terms of oil output or equipment supplies. We estimate that current oilfield development proposals likely to be actually finalized could add about 500,000 b/d to total Soviet oil production. More than half of this production, however, would probably go to the Western partner.

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If the Soviets are to meet production targets without a large contribution from joint ventures, they would have to substantially expand domestic production of petroleum equipment, sharply increase imports of Western equipment, or pursue a combination of expanded production and increased imports. This latter option, however, would have serious consequences for the economy.

We believe that Moscow will probably be unable—and to some extent unwilling—to expand the petroleum equipment sector rapidly enough to completely satisfy equipment demand. Expanded production of domestic petroleum equipment would consume an ever greater share of scarce high-quality steel, instrumentation, and other components. Moscow would also need to undertake a major program to expand and modernize manufacturing capacity in the petroleum equipment sector, reducing the availability of machine tools and construction equipment and supplies for other economic sectors. A key link in Gorbachev's economic revitalization program is the reequipping of Soviet industry with more productive and advanced machine tools. The supply of such equipment is already limited, and a further erosion in the availability of machine tools would add an additional constraint to realizing Gorbachev's economic goals.

Eastern Europe, moreover, probably cannot provide the Soviets with much more petroleum equipment than is currently delivered. Moscow's CEMA allies—whose economies are already strapped—are showing increasing reluctance to serve as suppliers to the Soviet petroleum sector. In any case, East European petroleum equipment generally is only marginally better than Soviet equipment. For example, none of the CEMA countries has more than a low capability for offshore operations or for deep-sour oil and gas development under high pressures and high temperatures.

With neither domestic suppliers nor East European firms able to satisfy Moscow's petroleum equipment requirements, the Soviets would probably need to increase imports of Western oil equipment, particularly drill pipe, well casing, wellheads, pumping equipment, and drilling rigs. Among other things, the

Soviets will also probably need to buy expensive turnkey oil-treatment plants and pipeline gathering networks for the North Caspian basin.

The amount of imports involved could be sizable.

Indeed, [ ] indicated recently that Soviet needs for imported equipment could be at least three times the current requirement by 1995. We estimate that—given no improvement in joint-venture proposals—annual imports of Western oilfield equipment, including drill pipe and well casing, could increase from their current level of roughly \$2 billion to as much as \$6 billion by the mid-1990s, provided Moscow undertakes little expansion of domestic manufacturing capacity but remains committed to keeping oil production above 12 million b/d.

Given these projections, we believe that the United States would have promising opportunities to sell oilfield equipment to the Soviet Union. US equipment is state of the art and generally superior to West European equipment for handling tough technical challenges. US suppliers would probably have good opportunities to sell drill pipe and well casing, a market that has long been dominated by West European and Japanese suppliers. [ ]

[ ] In late 1988 the Soviets placed an order with a US company for 80,000 metric tons of oilfield pipe valued at \$70-75 million, marking the first significant Soviet pipe order for a US firm in several years.

US companies, however, would face tough competition from West European petroleum equipment manufacturers, who frequently offer favorable prices and financing. [ ]

[ ] Furthermore, purchases of Soviet energy by West European countries—particularly natural gas—facilitate purchases

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from them. Finally, the Soviets appear to see little threat of equipment embargoes from West European companies. With thousands of West European jobs dependent on Soviet orders, Moscow may hope that West European governments will be reluctant to agree to US policy initiatives that run counter to Soviet interests.

Despite Moscow's pressing need for petroleum technology and equipment, the diversion of hard currency to purchase petroleum equipment would reduce its ability to buy other much-needed items. Hard currency supply is expected to remain tight and limit the growth of all imports. Furthermore, other industrial sectors—particularly the consumer-related industries—are competing for a larger slice of the import pie. This trend is already evident in our estimates of Soviet orders of Western machinery and equipment. In 1987 the energy sector accounted for 40 percent of orders placed during the year, while consumer-related sectors accounted for only 6 percent; in 1988 the energy sector's share fell to 32 percent while the consumer-related sectors' share jumped to 14 percent. In addition, the Soviets are not eager to increase their dependence on Western imports for security reasons.

Whatever the prospects for increased US exports, Moscow is faced with a dilemma in its efforts to meet its oil-equipment needs that increased joint ventures

could help resolve. But failure to expand Western involvement in joint ventures—particularly in petroleum equipment manufacture—would leave the Soviet oil industry in a "catch-22" situation in the 1990s. There would be little chance of stabilizing oil output without an enormous infusion of investment resources to produce oilfield equipment and build new manufacturing plants or without substantial expenditures on imports of Western equipment. Diversion of such resources, however, would undermine regime efforts to stimulate economic growth and improve consumer welfare. On the other hand, keeping oil-industry investment constant or constraining imports of equipment would cause oil output to drop sharply and lead to a sharp reduction in the availability of oil for export. This, in turn, would severely reduce hard currency earnings and likewise reduce Moscow's ability to purchase much-needed machinery, foodstuffs, and consumer goods.

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## Appendix A

### Joint-Venture Proposals

| Proposal   | Supplier                                   | Status                      | Probability     |
|--|--|-----------------------------|-----------------|
| <b>Exploration and field services</b>  |  |                             |                 |
| Set up joint-venture service company for well stimulation in West Siberia                          | Canada                                     | Recently concluded          |                 |
| Modernize oil processing/separation facilities in West Siberia                                     | West Germany                               | Signed                      |                 |
| Conduct seismic surveys in West Siberia  | United States                              | Early negotiations          | Moderate        |
| Explore Barents Sea  | Finland                                    | NA                          | Moderate        |
| Install remote automated well-control and integration system                                       | Canada/United States                       | Early negotiations          | Low to moderate |
| Conduct seismic survey in North Caucasus   | France                                     | NA                          | Low to moderate |
| Conduct seismic surveys in offshore northern Caspian Sea   | United States                              | Early negotiations          | Low to moderate |
| Set up joint-venture service company for well stimulation in North Caucasus                        | France                                     | NA                          | Low             |
| <b>Joint development</b>   |  |                             |                 |
| Install subsea well-completion and well-control systems and gathering pipeline off Sakhalin Island | United Kingdom                             | Recently completed          |                 |
| Explore and develop lease area in North Caspian basin  | United States                              | Final stages of negotiation | High            |
| Develop fields off Sakhalin Island   | United States                              | Final stages of negotiation | High            |
| Develop gasfield in Barents Sea  | Norway                                     | NA                          | Low to moderate |
| Jointly develop oilfields in Komi ASSR   | United States                              | Stalled negotiations        | Low             |
| <b>Petroleum equipment manufacture</b>   |  |                             |                 |
| Manufacture components for downhole electric submersible pumps                                     | United States                              | Early discussions           | Low             |
| Manufacture subsea wellheads   | Canada, Norway, Finland, and United States | Early discussions           | Low             |
| Manufacture downhole well-stimulation tool   | United States                              | Early discussions           | Low             |
| Produce heavy-duty, deep-drilling rigs   | United States                              | NA                          | Low             |
| Produce light, mobile, modular rigs  | United States                              | NA                          | Low             |
| Design and develop system for preparation and control of drilling fluid                            | United States                              | NA                          | Low             |
| Produce measurement-while-drilling equipment for deviated drilling                                 | United States                              | NA                          | Low             |
| Produce cold-weather diesel engines  | Canada                                     | NA                          | Low             |

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## Appendix B

### Potential Transfer of Strategic Technology

Most of the oilfield technology required by the Soviets is not COCOM controlled, except for technology related to geophysical exploration. However, the advanced sensors used for data collection and the computers used for data processing have almost direct application in a variety of military missions (see inset). Indeed, geophysical devices for magnetic, acoustic, and ultrasonic sensing, together with state-of-the-art, computer-assisted technology, have greatly improved Western capability for strategic and tactical warfare. Gravimeters are used for missile guidance; magnetotelluric systems for underground low-frequency military communications; magnetometers for upgraded magnetic-anomaly-detection systems (locating and mapping areas with natural magnetic anomalies on the seafloor that could be used to conceal submarines); and magnetometers and acoustic sensors for locating, identifying, and tracking missile-launching and conventional tactical submarines and for conducting antisubmarine warfare operations.

In addition, even less sophisticated equipment such as the minicomputers used for well and mud logging and for monitoring drilling operations is easily designed to meet military specifications for arctic, desert, and naval use. Nearly all petroleum operations include data-recording, transmission, and processing equipment.

In contrast to petroleum equipment, most manufacturing technology for petroleum equipment has potential military applications. Access to Western numerically controlled machine tools, precision grinding and milling equipment, and heat-treatment technology would certainly benefit Soviet defense industries.

#### Exploration Technologies With Potential Strategic Use

| Sensor Technology     | Military Applications   |
|-----------------------|---|
| Acoustic              |   |
| Geophones             | Battlefield surveillance systems, antisubmarine warfare (ASW)                 |
| Hydrophones           |   |
| Magnetometers         | ASW, magnetic anomaly detection, mine detection                               |
| Gravimeters           | Inertial navigation and guidance  |
| Processing Technology |   |
| Computers             | Image processing; command, control, and communications; ASW; data integration |
| Array processors      |   |
| Software              |   |

The Soviets and some Western partners are aware of potential conflict with COCOM regulations and are trying to address some of these concerns. In one case the Soviets requested a US firm to provide less capable equipment if there was any chance that acquiring more sophisticated equipment would cause delays. In addition, some US companies will contract out exploration services so that the joint-venture company cannot claim ownership of much of the exploration equipment. Even so, bringing the equipment into the USSR will still require approval of export licenses.